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NEW SIRENIAN FROM THE TERTIARY OF PORTO RICO, WEST INDIES[1]

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Introduction

Two specimens of fossil mammals were secured by Dr. Chester A. Reeds from the Tertiary limestones of Porto Rico while on the natural history survey of that island undertaken by the Academy. One consists of a lower jaw and two vertebræ, the other of a few incomplete ribs. The second specimen is probably sirenian but not further identifiable. The lower jaw, however, is nearly complete, with the molar teeth preserved and alveoli of the premolars, and is of considerable interest.

Tertiary mammals have been practically unknown from the West Indies. The only one recorded in scientific literature, so far as I know, is represented by the skull and jaws from so-called Eocene of Jamaica, described many years ago by Owen under the name of *Prorastomus sirenoides.* It is also a sirenian, of a more primitive and generalized type. In the March, 1914, number of the magazine "Revista de las Antillas," Senor Narciso Rabell Cabrero has published photographs of two mammal bones from the Porto Rican Tertiary, a scapula and axis, and discussed their possible affinities. He did not compare them with Sirenia, and naturally found the relationship to terrestrial mammals very perplexing. The scapula is characteristically sirenian, having the peculiar curvature and backward extension of the blade clearly indicated and agreeing in

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other features with the older stages of the Halicoridæ. The axis agrees with the same types, comparing with *Halitherium*, but is less certainly identifiable.

The lower jaw found by Dr. Reeds is clearly distinct from *Prorastomus* and from the modern manatee (*Manatus* = *Trichechus*), and appears to be related to *Halitherium* of the European Oligocene. Unfortunately the front of the jaw is missing, so that the identification is in some degree provisional; but the form, proportions and spacing of the teeth preserved or indicated by their alveoli agrees with this genus, as does also the form of the lower jaw. It is with some hesitation that I refer it to an Old World genus, but the known range of the manatee in Africa and tropical America, with fossil representatives in Belgium as well as along the Atlantic coast of the United States, makes it quite reasonable to believe that *Halitherium* also ranged on both sides of the Atlantic in Tertiary times. Its modern descendants, the Dugongs, are found in the Indian Ocean and Red Sea.

The lower jaw here described is about the size of a manatee jaw, and with the same great depth of angle, high condyle, heavy coronoid process, deep pterygoid fossæ. It is much deeper and heavier posteriorly than in *Prorastomus* and somewhat deeper under the molars. Three molars are preserved. Although badly worn and the inner sides much damaged by weathering, it is evident that they were rather short-crowned teeth of the usual primitive sirenian pattern of five robust cusps arranged in two cross-crests and a small heel. The last molar was apparently considerably longer than the second, with a much more distinct heel supported on a small median posterior root which the anterior molars lack. The first molar appears considerably smaller than the second, but this is chiefly due to its being more worn. Of the differentiation of m_3 from m_1 and m_2 there is no question. The premolars are indicated by alveoli. P_4 (more probably dp_4) was two-rooted, much smaller than m_1. P_3 has a single oval root, with a diastema behind it equal to its own greater diameter. P_2 is doubtfully indicated by an obscure round alveolus with a diastema separating it from p_3.

In front of this the jaw is broken off obliquely and it is impossible to say what it was like. So far as they go, the characters agree with *Halitherium schinzi*, save for the somewhat shorter and deeper posterior portion of the jaw, smaller molars, and greater reduction of the premolars. From *Manatus* the jaw differs in the reduction of the premolars and differentiation of the last molar; from *Prorastomus* in the much greater depth of the jaw posteriorly, reduction of the premolars and larger size of the molars.

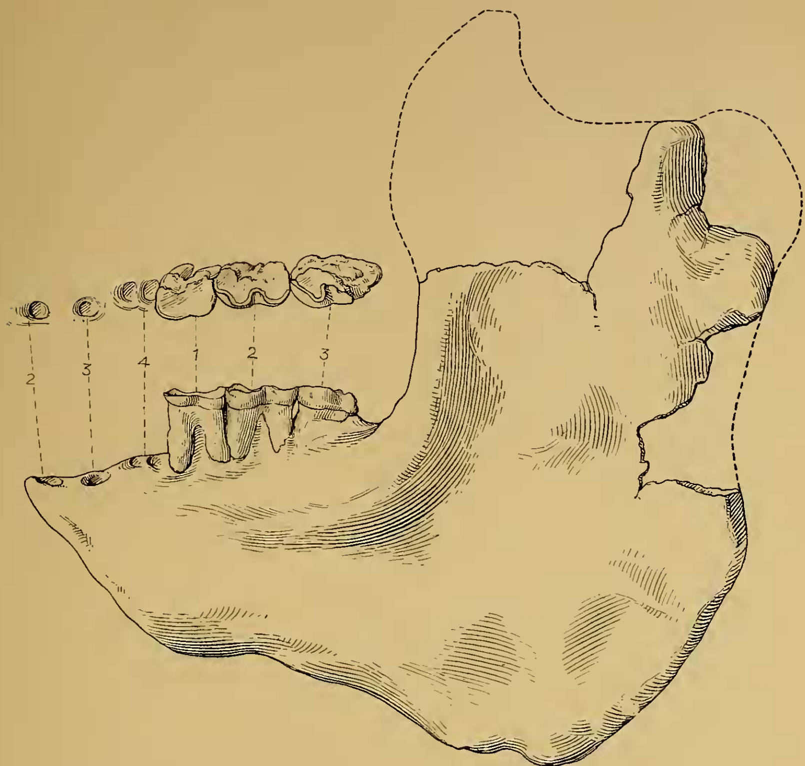

FIG. 1.—? *Halitherium antillense, lower jaw, left ramus, type specimen, one-half natural size*

External view, symphyseal region missing. Tertiary shales near Juana Diaz, Porto Rico, found by C. A. Reeds, 1915.

DESCRIPTION OF SPECIES

? *Halitherium antillense* sp. nov.

Type: a lower jaw lacking symphyseal region and anterior teeth; the molars damaged on inner side; a middle cervical and the first dorsal vertebra associated, neither complete.

Type locality: Shale bluff, west bank Jacagnas River, 1 km. north, 1 km. west of Juana Diaz, Porto Rico.

Horizon: Tertiary calcareous shales of uncertain age.

Collector: Chester A. Reeds, N. Y. Academy of Sciences-Porto Rico Survey, July 1, 1915.

Diagnosis.—Size and proportions of jaw in accord with *H. schinzi,* premolars more reduced, the third (fourth of *Lepsius*) having but one root and the roots of the fourth (milk-molar, dp_4) indicating a smaller tooth than the corresponding tooth in *H. schinzi.* It agrees better with Abel's diagnosis (Abel, 1904, p. 16, 25) of *H. christoli* Fitz., from the upper marine Molasse of Linz (Middle Miocene), but Fitzinger's (Fitzinger, 1842) figures of the jaw in this species are not accessible.

Probable Affinities.—Accepting provisionally the reference of the Porto Rico sirenian to *Halitherium,* it may be of interest to note where it stands in the evolutionary history of the Sirenians.

It is generally accepted at present that this group is descended from a common stock with the Proboscidea—that is to say, they are derived from terrestrial ungulates with short five-toed plantigrade feet, a complete series of teeth, bunodont molars, four or five cusped, the posterior premolars partly molariform, the anterior ones simple, canines not notably enlarged, but a tendency to enlargement of a pair of upper and lower incisors—and a variety of other characters which I need not notice. *Mœritherium,* of the Upper Eocene and Lower Oligocene of Egypt, stands not very far from this common stock; but whether or not it be really ancestral to the Proboscidea it has gone a short distance in that direction, the limbs being somewhat long and straight and the teeth and skull approaching in some degree the Proboscidean specialties more clearly shown in *Palæomastodon* of the Egyptian Oligocene.

Prorastomus, on the other hand, may be taken as representing the primitive Sirenian. Unfortunately we do not know its skeleton characters. But being found in a marine limestone it probably was already adapted to aquatic life. The long narrow skull, rather slender jaws, teeth conforming to the primitive type indicated and not widely different from those of *Mœritherium,* all point to its ancestral position.

From this primary stock we find three or four diverse lines of specialization. In the Manatee the front teeth disappear and the cheek teeth all become molariform and appear to increase in number, pushing upward and forward in the jaw to replace those lost by wear. This increase in number of the cheek teeth is supposed to be due to reduplication of the molars from behind, a fourth, fifth, sixth true molar etc. appearing *de novo* (Thomas and Lydekker, 1897).

In the Dugongs, on the other hand, one pair of upper incisor teeth is retained and enlarged into tusks, while the cheek teeth are progressively reduced in number, the premolars becoming smaller and simpler and the anterior ones disappearing, while there is no tendency to increase in number of the true molars. The skull in both Manatee and Dugong is much shortened and widened, the jaws deepened and the front of muzzle and jaw bent downwards and covered with horny plates for triturating the food. Various other specializations occur in the skull, carried considerably further in the Dugong.

A third line, closely related to the Dugong in most of its skull structure, but lacking the tusks, and with the reduction of the cheek teeth carried to complete disappearance, is represented by the recently extinct *Rhytina* of the North Pacific.

A fourth and very distinct line is represented by an imperfectly known genus *Desmostylus* found in the Miocene of Japan, California and Oregon. In this the skull retains more of its primitive proportions, while the tusks are large in both upper and lower jaws and the cheek teeth become hypsodont or high-crowned and of a very curious pattern.

FIG. 2.—? *Halitherium antillense, parts of cervical (right) and anterior dorsal (left) vertebræ of type specimen*

Posterior views, half natural size.

Halitherium is generally accepted as an ancestral Dugong. *Eotherium* Owen, *Eosiren* Andrews, *Protosiren* Abel, *Archæosiren* Abel, all from the Eocene of Egypt, are a closely related group of genera, all but the first due to the activity of recent investigators in the Fayûm faunas, especially Andrews and Abel. They represent collectively a primitive stage in the Dugong line.

Place of Origin of the Dugongs

As the Manatees have not been found outside the Atlantic Basin, it is commonly assumed that they originated there or else migrated from the Tertiary Mediterranean Basin. The oldest fossil Dugongs being found in Egypt and Italy, later stages in Germany, France and Belgium, the modern forms in the Red Sea and Indian Ocean, it has been assumed that they originated in the Mediterranean Basin, found their way to the north European shores and in the opposite direction into the Indian Ocean, and thence perhaps finally to the North Pacific, but never reached the western coasts of the Atlantic.

The discovery here presented would seem to show that the distribution of primitive Dugongs in the North Atlantic was wider than was supposed. Why they disappeared in this region, while the rival group of Manatees survived is an interesting question; but the evidence as to the distribution and range of the Sirenia during the Tertiary is so scanty and incomplete that any further speculations are scarcely worth while.

Molar-premolar Formula in Sirenians

The molar-premolar formula in the Sirenia is difficult to state correctly, partly because of certain peculiarities in the premolar replacement, partly the doubtful interpretation of alveoli where the teeth themselves are not known. So far as the Manatees are concerned, I have accepted the interpretation placed by Thomas and Lydekker upon the cheek teeth, involving an actual increase in the number from the primitive formula of four premolars and three molars which pretty certainly characterized the ancestors of all placental mammals. This increase in number of molars would appear to be attained by extension of the dental lamina posteriorly and budding from the tooth germ of the third molar, thus continuing the process by which the third is derived from the second and the second from the first. That such an increase, whether by this or other means, does occur normally in the number of true molars in certain other placental phyla, appears beyond question. *Otocyon, Centetes, Myrmecobius* and various Cetaceans may serve as illustrations. The abnormal occurrence of an extra molar or premolar in the series is not a rare occurrence among other placental mammals; this is usually ascribed to reduplication.

It is by no means clear that there is any such increase in the number of either premolars or true molars in any of the other Sirenians living or extinct. Andrews ascribes four lower molars and four premolars to *Eosiren,* and Lepsius gives the formulas as: $i\frac{3}{3}\ c\frac{1}{1}\ p\frac{4}{4}\ m\frac{4}{4}$ in *Prorastomus;* $i\frac{1}{(3)}\ c\frac{1}{1}\ p\frac{3}{4}\ m\frac{4}{4}$ in *Halitherium;* $i\frac{2}{3}\ c\frac{0}{1}\ p\frac{1-2}{2-3}\ m\frac{4}{4}$ in *Halicore.* This would seem to indicate four true molars as the normal number in this family. Abel, however, has shown (Abel, 1906) that the fourth milk molar in the Halicoridæ is retained exceptionally late in life, and sometimes intercalated between the last successional tooth and the first true molar. He accounts in this way for the apparent series of eight postcanine teeth in the lower jaw of *Eosiren, Halitherium* and the later Halicoridæ without finding it necessary to suppose the addition of a molar from behind to the usual placental series. Possibly the eight postcanine teeth of *Prorastomus* are to be explained in this way; but the interpretation of the alveoli in the jaw in this and other genera is apparently somewhat doubtful. Pending the publication of Abel's final conclusions, it seems best to accept his present views provisionally, as I have done in the above diagnosis and discussion of affinities of *H. antillense*. The number of true molars is considered as unchanged from the primitive series of three, and the alveoli of the tooth preceding them are considered as of milk-molar four, although there is no proof that this tooth had a successor in *Halitherium*.

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